

MC33078, MC33079

Low Noise Dual/Quad Operational Amplifiers

The MC33078/9 series is a family of high quality monolithic amplifiers employing Bipolar technology with innovative high performance concepts for quality audio and data signal processing applications. This family incorporates the use of high frequency PNP input transistors to produce amplifiers exhibiting low input voltage noise with high gain bandwidth product and slew rate. The all NPN output stage exhibits no deadband crossover distortion, large output voltage swing, excellent phase and gain margins, low open loop high frequency output impedance and symmetrical source and sink AC frequency performance.

The MC33078/9 family offers both dual and quad amplifier versions, tested over the automotive temperature range and available in the plastic DIP and SOIC packages (P and D suffixes).

- Dual Supply Operation: ± 5.0 V to ± 18 V
- Low Voltage Noise: $4.5 \text{ nV}/\sqrt{\text{Hz}}$
- Low Input Offset Voltage: 0.15 mV
- Low T.C. of Input Offset Voltage: $2.0 \mu\text{V}/^\circ\text{C}$
- Low Total Harmonic Distortion: 0.002%
- High Gain Bandwidth Product: 16 MHz
- High Slew Rate: 7.0 V/ μs
- High Open Loop AC Gain: 800 @ 20 kHz
- Excellent Frequency Stability
- Large Output Voltage Swing: +14.1 V/ -14.6 V
- ESD Diodes Provided on the Inputs

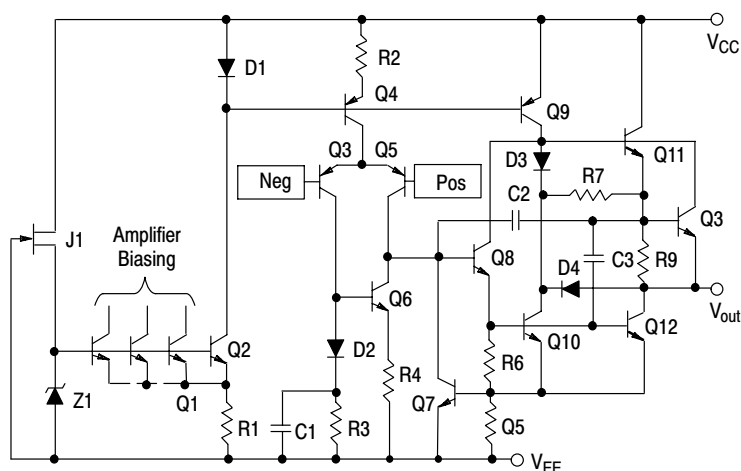


Figure 1. Representative Schematic Diagram
(Each Amplifier)

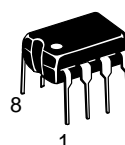


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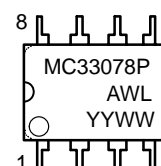
<http://onsemi.com>

MARKING DIAGRAMS

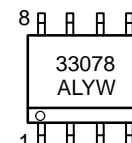
DUAL



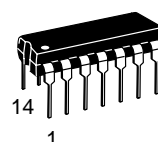
PDIP-8
P SUFFIX
CASE 626



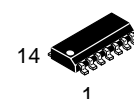
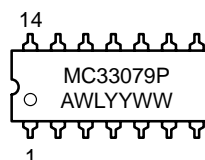
SO-8
D SUFFIX
CASE 751



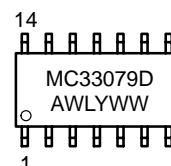
QUAD



PDIP-14
P SUFFIX
CASE 646



SO-14
D SUFFIX
CASE 751A



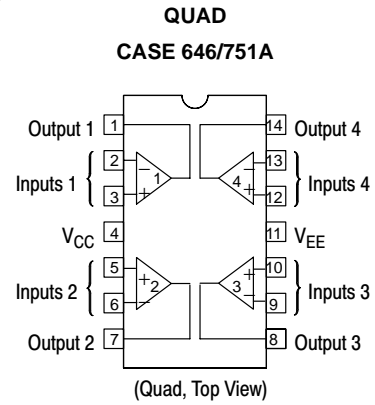
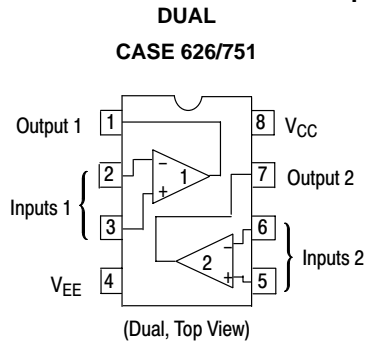
A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MC33078D	SO-8	98 Units/Rail
MC33078DR2	SO-8	2500 Tape & Reel
MC33078P	PDIP-8	50 Units/Rail
MC33079D	SO-14	55 Units/Rail
MC33079DR2	SO-14	2500 Tape & Reel
MC33079P	PDIP-14	25 Units/Rail

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PIN CONNECTIONS



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage (V_{CC} to V_{EE})	V_S	+36	V
Input Differential Voltage Range	V_{IDR}	Note 1	V
Input Voltage Range	V_{IR}	Note 1	V
Output Short Circuit Duration (Note 2)	t_{SC}	Indefinite	sec
Maximum Junction Temperature	T_J	+150	°C
Storage Temperature	T_{stg}	-60 to +150	°C
Maximum Power Dissipation	P_D	Note 2	mW

1. Either or both input voltages must not exceed the magnitude of V_{CC} or V_{EE} .
2. Power dissipation must be considered to ensure maximum junction temperature (T_J) is not exceeded (see Figure 2).

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DC ELECTRICAL CHARACTERISTICS ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $T_A = 25^\circ\text{C}$, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Input Offset Voltage ($R_S = 10\ \Omega$, $V_{CM} = 0\text{ V}$, $V_O = 0\text{ V}$) (MC33078) $T_A = +25^\circ\text{C}$ $T_A = -40^\circ$ to $+85^\circ\text{C}$ (MC33079) $T_A = +25^\circ\text{C}$ $T_A = -40^\circ$ to $+85^\circ\text{C}$	$ V_{IO} $	– – – –	0.15 – 0.15 –	2.0 3.0 2.5 3.5	mV
Average Temperature Coefficient of Input Offset Voltage $R_S = 10\ \Omega$, $V_{CM} = 0\text{ V}$, $V_O = 0\text{ V}$, $T_A = T_{low}$ to T_{high}	$\Delta V_{IO}/\Delta T$	–	2.0	–	$\mu\text{V}/^\circ\text{C}$
Input Bias Current ($V_{CM} = 0\text{ V}$, $V_O = 0\text{ V}$) $T_A = +25^\circ\text{C}$ $T_A = -40^\circ$ to $+85^\circ\text{C}$	I_{IB}	– –	300 –	750 800	nA
Input Offset Current ($V_{CM} = 0\text{ V}$, $V_O = 0\text{ V}$) $T_A = +25^\circ\text{C}$ $T_A = -40^\circ$ to $+85^\circ\text{C}$	I_{IO}	– –	25 –	150 175	nA
Common Mode Input Voltage Range ($\Delta V_{IO} = 5.0\text{ mV}$, $V_O = 0\text{ V}$)	V_{ICR}	± 13	± 14	–	V
Large Signal Voltage Gain ($V_O = \pm 10\text{ V}$, $R_L = 2.0\text{ k}\Omega$) $T_A = +25^\circ\text{C}$ $T_A = -40^\circ$ to $+85^\circ\text{C}$	A_{VOL}	90 85	110 –	– –	dB
Output Voltage Swing ($V_{ID} = \pm 1.0\text{ V}$) $R_L = 600\ \Omega$ $R_L = 600\ \Omega$ $R_L = 2.0\text{ k}\Omega$ $R_L = 2.0\text{ k}\Omega$ $R_L = 10\text{ k}\Omega$ $R_L = 10\text{ k}\Omega$	V_{O+} V_{O-} V_{O+} V_{O-} V_{O+} V_{O-}	– – $+13.2$ – $+13.5$ –	$+10.7$ -11.9 $+13.8$ -13.7 $+14.1$ -14.6	– – – -13.2 – -14	V
Common Mode Rejection ($V_{in} = \pm 13\text{ V}$)	CMR	80	100	–	dB
Power Supply Rejection (Note 3) $V_{CC}/V_{EE} = +15\text{ V}/-15\text{ V}$ to $+5.0\text{ V}/-5.0\text{ V}$	PSR	80	105	–	dB
Output Short Circuit Current ($V_{ID} = 1.0\text{ V}$, Output to Ground) Source Sink	I_{SC}	$+15$ -20	$+29$ -37	– –	mA
Power Supply Current ($V_O = 0\text{ V}$, All Amplifiers) (MC33078) $T_A = +25^\circ\text{C}$ $T_A = -40^\circ$ to $+85^\circ\text{C}$ (MC33079) $T_A = +25^\circ\text{C}$ $T_A = -40^\circ$ to $+85^\circ\text{C}$	I_D	– – – –	4.1 – 8.4 –	5.0 5.5 10 11	mA

3. Measured with V_{CC} and V_{EE} differentially varied simultaneously.

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AC ELECTRICAL CHARACTERISTICS ($V_{CC} = +15\text{ V}$, $V_{EE} = -15\text{ V}$, $T_A = 25^\circ\text{C}$, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Slew Rate ($V_{in} = -10\text{ V to } +10\text{ V}$, $R_L = 2.0\text{ k}\Omega$, $C_L = 100\text{ pF}$, $A_V = +1.0$)	SR	5.0	7.0	—	V/ μs
Gain Bandwidth Product ($f = 100\text{ kHz}$)	GBW	10	16	—	MHz
Unity Gain Bandwidth (Open Loop)	BW	—	9.0	—	MHz
Gain Margin ($R_L = 2.0\text{ k}\Omega$ $C_L = 0\text{ pF}$ $C_L = 100\text{ pF}$)	A_m	— —	—11 —6.0	— —	dB
Phase Margin ($R_L = 2.0\text{ k}\Omega$ $C_L = 0\text{ pF}$ $C_L = 100\text{ pF}$)	ϕ_m	— —	55 40	— —	Deg
Channel Separation ($f = 20\text{ Hz to } 20\text{ kHz}$)	CS	—	—120	—	dB
Power Bandwidth ($V_O = 27\text{ V}_{pp}$, $R_L = 2.0\text{ k}\Omega$, $\text{THD} \leq 1.0\%$)	BW_p	—	120	—	kHz
Total Harmonic Distortion ($R_L = 2.0\text{ k}\Omega$, $f = 20\text{ Hz to } 20\text{ kHz}$, $V_O = 3.0\text{ V}_{rms}$, $A_V = +1.0$)	THD	—	0.002	—	%
Open Loop Output Impedance ($V_O = 0\text{ V}$, $f = 9.0\text{ MHz}$)	$ Z_O $	—	37	—	Ω
Differential Input Resistance ($V_{CM} = 0\text{ V}$)	R_{in}	—	175	—	$\text{k}\Omega$
Differential Input Capacitance ($V_{CM} = 0\text{ V}$)	C_{in}	—	12	—	pF
Equivalent Input Noise Voltage ($R_S = 100\text{ }\Omega$, $f = 1.0\text{ kHz}$)	e_n	—	4.5	—	$\text{nV}/\sqrt{\text{Hz}}$
Equivalent Input Noise Current ($f = 1.0\text{ kHz}$)	i_n	—	0.5	—	$\text{pA}/\sqrt{\text{Hz}}$

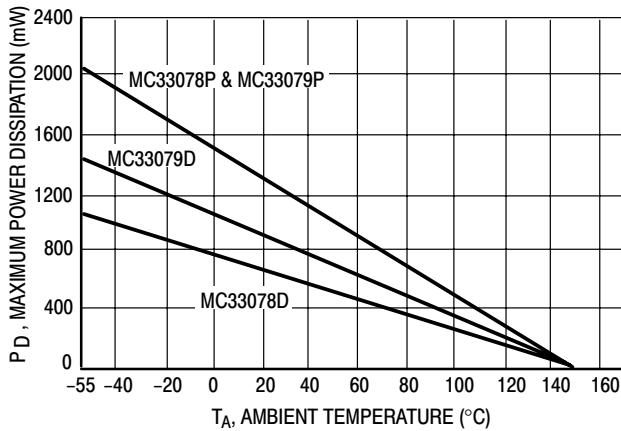


Figure 2. Maximum Power Dissipation versus Temperature

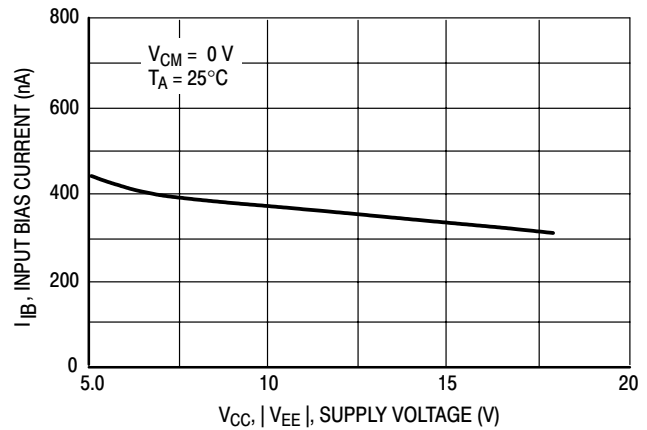


Figure 3. Input Bias Current versus Supply Voltage

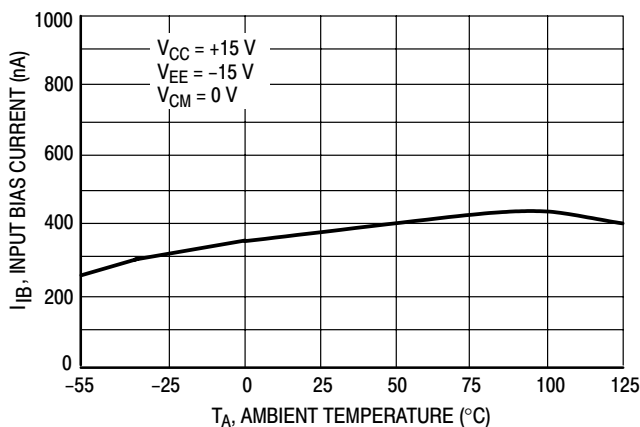


Figure 4. Input Bias Current versus Temperature

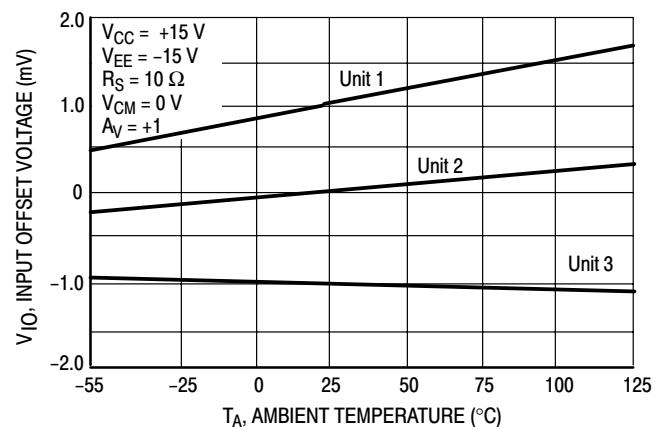
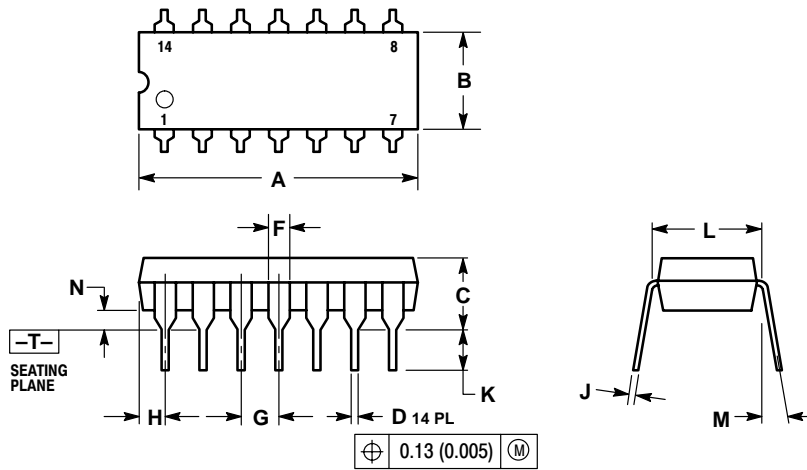


Figure 5. Input Offset Voltage versus Temperature

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PACKAGE DIMENSIONS

PDIP-14
P SUFFIX
CASE 646-06
ISSUE M

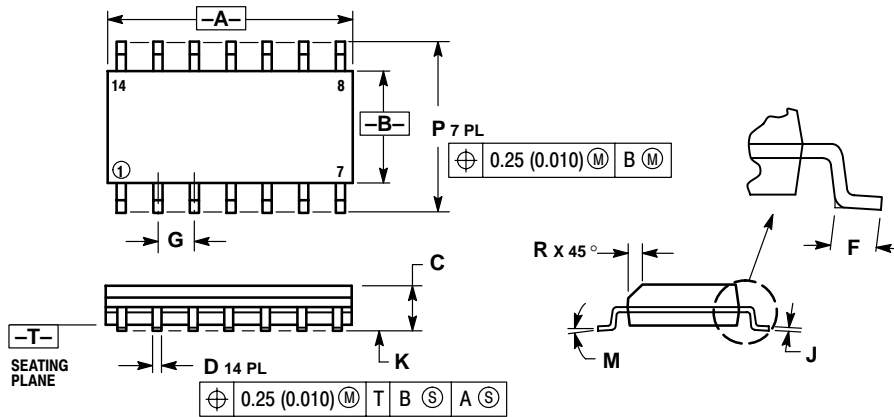


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	18.80
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.290	0.310	7.37	7.87
M	---	10°	---	10°
N	0.015	0.039	0.38	1.01

SO-14
D SUFFIX
CASE 751A-03
ISSUE F



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019